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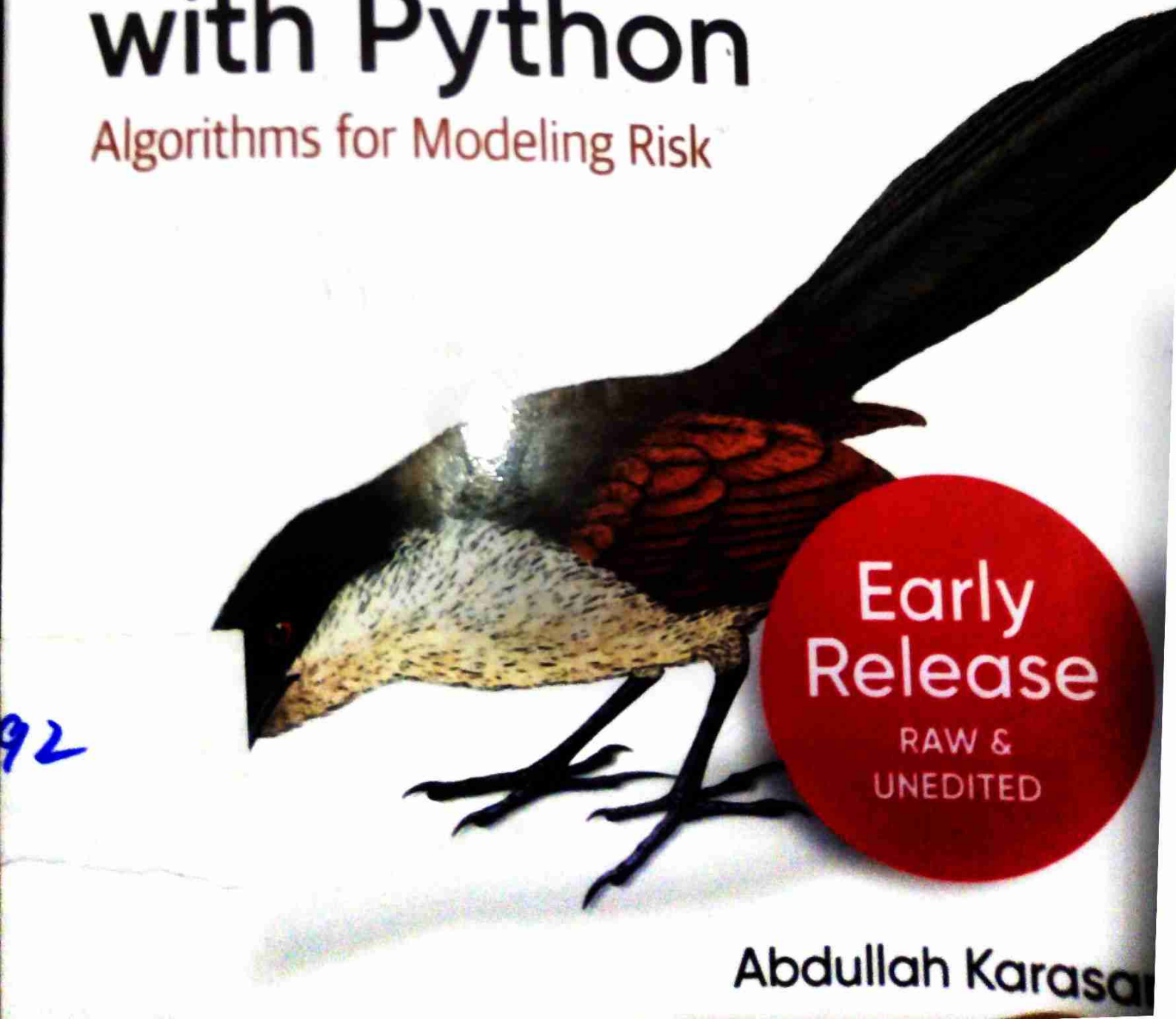
Machine Learning for Financial Risk Management with Python

Algorithms for Modeling Risk



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Abdullah Karasan

Chapter 1

Gives an introduction about the main risk management concepts. So, it covers risks, types of risks such as market, credit, operational, liquidity, risk management. After defining what the risk is, types of risks are discussed, and then risk management is explained and the issues of why it is important and how it can be used to mitigate losses is addressed. In what follows, asymmetric information, which can address the market failures are discussed. To do that, we will focus on the information asymmetry and adverse selection.

Chapter 2

Shows the time-series applications using traditional models, namely moving average model, autoregressive model, autoregressive integrated moving average model. In this part, we learn how to use an API to access financial data and how to employ it. This chapter main aims to provide us a benchmark to compare the traditional time series approach with recent development in time series modeling, which is the main focus of the next chapter.

Chapter 3

Introduces the deep learning tools for time series modeling. Recurrent Neural Network and Long Short Term Memory are two approaches by which we are able to model the data with time dimension. Besides, this chapter gives us an impression about the applicability of deep learning models to time series modeling.

Chapter 4

Focuses on the volatility prediction. Increased integration of financial markets has led to a prolonged uncertainty in financial markets, which in turn stresses the importance of volatility. Volatility is used in measuring the degree of risk, which is one of the main engagements of the area of finance. The fourth chapter deals with the novel volatility modeling based on Support Vector Regression, Neural Network, Deep Learning, and Bayesian approach. For the

sake of comparison of the performances, traditional ARCH and GARCH-type models are also employed.

Chapter 5

Employs machine learning-based models to boost estimation performance of the traditional market risk models, namely Value-at-Risk (VaR) and Expected Shortfall (ES). VaR is a quantitative approach for the potential loss of fair value due to market movements that will not be exceeded in a defined period of time and with a defined confidence level. Expected Shortfall, on the other hand, focuses on the tail of the distribution refering to big and unexpected losses. VaR model is developed using denoised covariance matrix and ES is developed incorporating liqudity dimension of the data.

Chapter 6

Tries to introduce comprehensive machine learning-based approach to estimate credit risk. Machine Learning models are applied based on the past credit information along with others. The approach starts with risk bucketing, which is suggested by Basel Accord and continue with different models bayesian estimation, Markov Chain model, support vector classification, random forest, neural network, and deep learning. In the last part of the chapter, the performance of these models will be compared.

Chapter 7

Gaussian Mixture model is used to model the liquidity, which is thought to be a neglected dimension in risk management. This model allows us to incorporate different aspects of the liquidity proxies in this chapter so that we will be able to capture the effect of liquidity on financial risk in a more robust way.

Chapter 8

Covers the operational risk, which may result in a failure mostly due to companies internal weakness. There are several sources of operational risks but fraud risk is one of the most time-consuming and detrimental one to the companies operations. Here, in this

chapter, fraud is will be our main focus and new approaches will be developed to have better-performing fraud application based on machie learning models.

Chapter 9

Introduces a brand new approach in modeling the corporate governance risk: Stock Price Crash. Many studies find an empirical link between stock price crash and corporate governance. This chapter, using Minimum Covariance Determinant model, attempts to unveil the relationship between the components of corporate governance risk and stock price crash.

Chapter 10

Makes use of synthetic data to estimate different financial risks. The aim of this chapter is to highlight the emergence of synthetic data that helps us to minimize the impact of limited historical data. So, synthetic data allows us to have large enough and high-quality data, which improves the quality of the model.